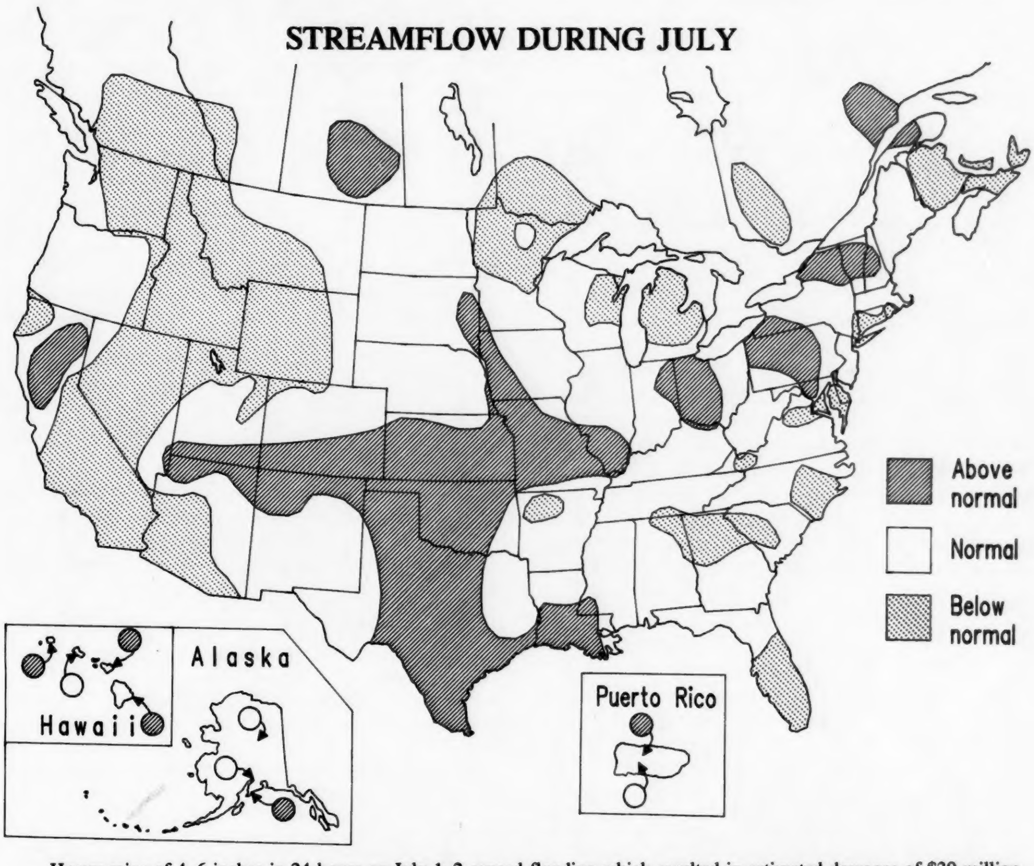
National Water Conditions

UNITED STATES
Department of the Interior
Geological Survey

CANADA
Department of the Environment
Water Resources Branch

JULY 1987

STREAMFLOW DURING JULY



Heavy rains of 4-6 inches in 24 hours on July 1-2 caused flooding which resulted in estimated damages of $30 million in north-central Ohio. No record-high peak discharges were reported but the Olentangy River at Claridon, Ohio (drainage area 157 square miles), peaked at 13,700 cubic feet per second (cfs) on July 3, about 1.5 times the discharge for the 100-year flood, but 1,200 cfs less than the January 1959 peak of record. In Minneapolis, Minnesota, where precipitation had been below normal through mid July, 8.96 inches of rain fell in 24 hours on July 23-24, exceeding the 100-year 24-hour rainfall by about 3 inches. Total precipitation for the week ending July 25 was 14.49 inches, double that recorded January 1-July 18, 1987. Two people were killed, many highways were flooded for days, and high winds or tornadoes damaged at least 50 homes. Peak discharges on several streams in the area were estimated to have exceeded peaks of record and the 100-year flood, but recurrence interval and discharge data were not available.

Streamflow was in the normal to above-normal range at about 69 percent of the 191 reporting index stations in southern Canada, the United States, and Puerto Rico, compared with the 58 percent in those ranges for last month. Total July flow was only about 17,500 cfs more than in July 1985, the lowest July in the 1983-87 period.

Mean July elevations for the Great Lakes (provisional National Ocean Service data) were lower than those for July 1986. The level of Utah's Great Salt Lake fell 0.50 foot during July, reaching 4,210.70 feet above National Geodetic Vertical Datum of 1929 on July 31. Contents of 78 percent of reporting reservoirs were near or above average for the end of July, compared with 81 percent for the end of June.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged a below-normal 875,900 cfs during July, 9.5 percent below median and 17.7 percent below last month's flow.

SURFACE-WATER CONDITIONS DURING JULY 1987

Flows generally increased from June to July only in Saskatchewan, North Dakota, Kansas, Tennessee, Kentucky, Ohio, Pennsylvania, New Jersey, Vermont, and Florida. Streamflow generally changed variably in Nebraska, Missouri, Illinois, Indiana, Quebec, New York, Maryland, South Carolina, and Georgia. Alaskan flows changed seasonally. Flow generally decreased in the rest of southern Canada and the United States.

Streamflow was in the normal to above-normal range at about 69 percent of the 191 reporting index stations in southern Canada, the United States, and Puerto Rico, compared with the 58 percent in those ranges for last month. This is the lowest percentage of stations with flow in the normal to above-normal range for July in the last 5 years. Total July flow was the second lowest for July in the last 5 years, but only about 17,500 cubic feet per second (cfs) more than in July 1985, the lowest July during the period.

New July extremes occurred at only 3 index stations. The monthly mean flow of 798 cfs (535 percent of median) on Oil Creek at Rouseville, Pennsylvania (drainage area 300 square miles), was the highest in 58 years of record, exceeding that of 1958 by 51 cfs. Monthly mean flow of Contentnea Creek at Hookerton, North Carolina (drainage area 729 square miles), was 59.0 cfs (22 percent of median), 4.3 cfs less than the 1952 minimum, and the lowest for July in 58 years of record. The monthly mean flow of 331 cfs on Smith River near Crescent City, California (drainage area 609 square miles), was the lowest for July in 55 years of record, 6 cfs less than the 1959 low. Hydrographs of streamflow for two index stations at which new extremes occurred are at the top of page 4. The other hydrographs on the left side of page 4 are for sites at which flows for this month vary from above normal to below normal, and cumulative runoff for the water year is 323, 174, and 121 percent of median, respectively. The other hydrographs on the right side of the page are for sites where flows for this month are below normal, and cumulative runoff for the water year is 49, 101, and 31 percent of median, respectively.

Mean July elevations for the Great Lakes (provisional National Ocean Service data) ranged from 0.13 foot (Lake Superior) to 1.32 feet (Lake Ontario) lower than those for July 1986. Levels rose from last month on both Lake Superior (+0.10 foot) and Lake Erie (+0.04 foot). Levels fell on both Lake Huron (−0.07 foot) and Lake Ontario (−0.29 foot). Stage hydrographs for Lakes Superior, Huron, Erie, and Ontario are on page 5.

The level of Utah's Great Salt Lake fell 0.50 foot during July, reaching 4,210.70 feet above National Geodetic Vertical Datum of 1929 on July 31. Lake level has fallen 1.15 feet since the March 30, 1987, seasonal high of 4,211.85 feet above NGVD of 1929 (see graph on page 5), which equaled last year's record high set July 3-8.

Contents of 78 percent of reporting reservoirs were near or above average for the end of July, compared with 81 percent for the end of June. Most reporting reservoirs in Texas, New Mexico, Colorado, and Utah had contents of more than 5 percent of normal maximum contents above the average for the end of July. In contrast, most reporting reservoirs in Maine, New Jersey, North Dakota, Wyoming, Idaho, Nevada, California, and Arizona had contents of more than 5 percent of normal maximum contents below the average for the end of July. Graphs of contents for seven reservoirs are shown on page 6 with contents for the 100 reporting reservoirs given on page 7.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged a below-normal 875,900 cfs during July, 9.5 percent below median and 17.7 percent below last month's flow. Mean flow of the St. Lawrence River at Cornwall, Ontario, was in the above-normal range for the 30th consecutive month. Flow hydrographs for both the combined and individual flows of the "Big 3" are shown on page 10. Dissolved solids and water temperatures at five large river stations are given on page 8. July flows of the "Big 3" and other large rivers are given in the Flow of Large Rivers table on page 9.

July precipitation (provisional National Weather Service data) is shown by the Total Precipitation and Percentage of Normal Precipitation maps on page 10. Total precipitation exceeded 6 inches at 23 cities scattered around the United States during the month. Those cities with more than 6 inches of precipitation that also had record-high totals for July (amounts in inches) were Minneapolis (17.90), Minnesota, and La Crosse (9.35), Wisconsin. Record low precipitation for July fell at Augusta (1.02), Georgia; Jackson (1.04), Mississippi; Beckley (1.66), West Virginia. Total Precipitation and Percentage of Normal Precipitation maps are on page 10. The Crop Moisture map and Drought Severity map (page 11) for August 1 show the differences between short-term and long-term soil moisture for that date. August through October outlook maps for both temperature and precipitation are on page 15.

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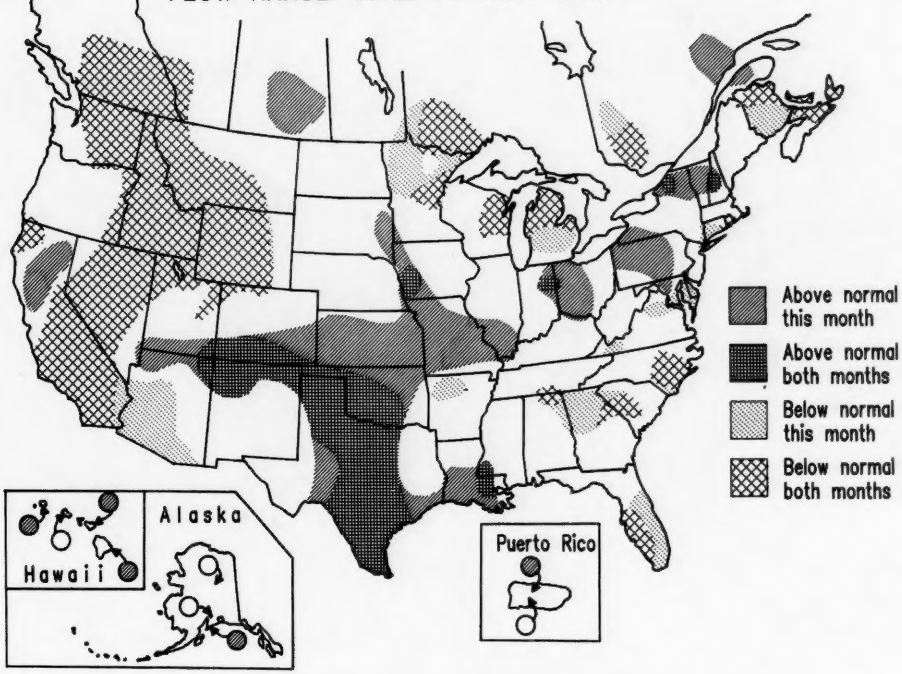
PERSISTENCE IN, OR MOVEMENT INTO, THE BELOW-NORMAL OR ABOVE-NORMAL FLOW RANGE: JUNE TO JULY 1987



SUMMARY OF JULY 1987 STREAMFLOW

[Flow ranges]

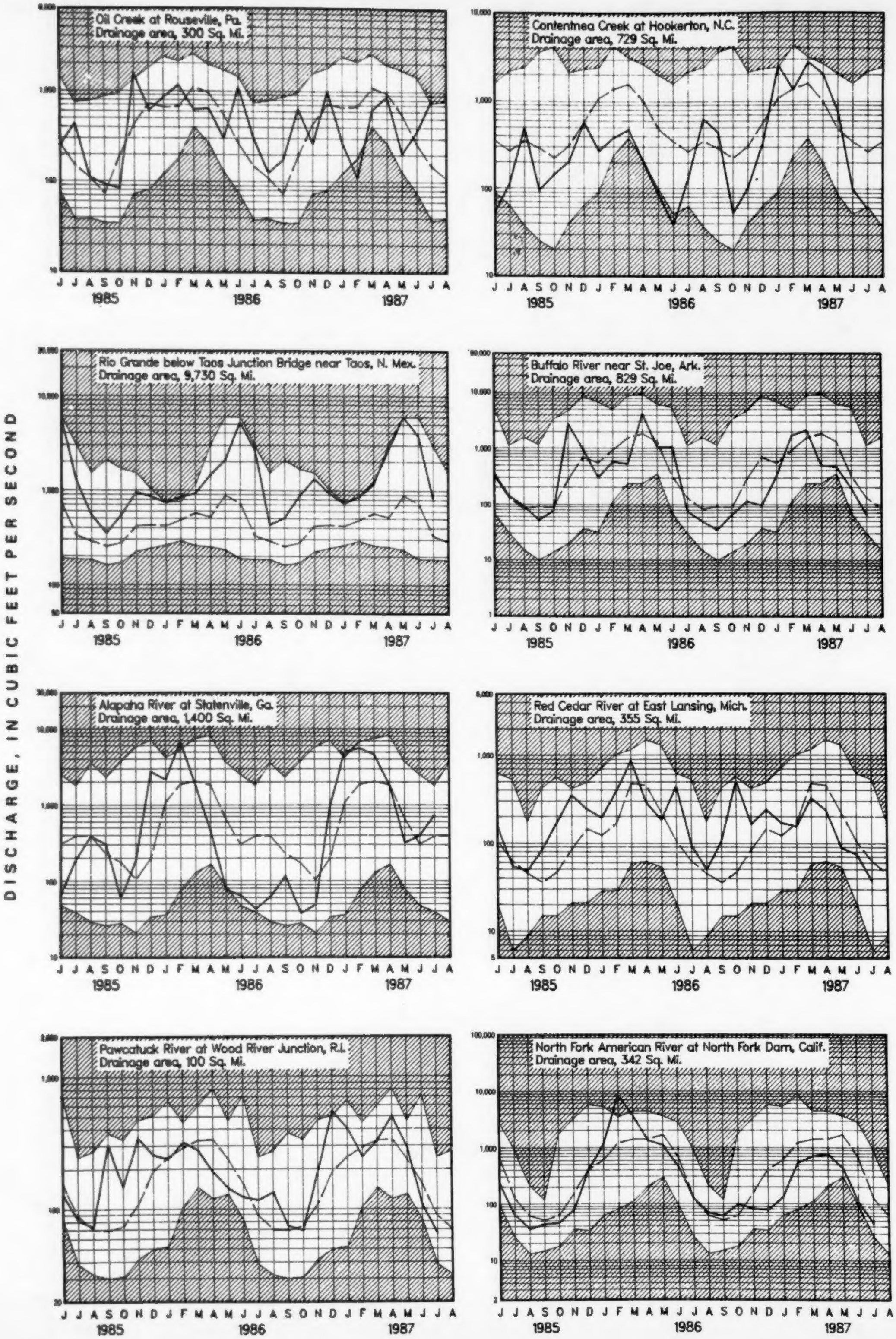
Area	Below normal range		Normal range		Above normal range		Number of stations	
	No.	Percent	No.	Percent	No.	Percent	Reporting data	Missing data
Conterminous United States.	50	30.7	79	48.5	34	20.9	163	0
Alaska, Hawaii, and Puerto Rico.	1	10.0	4	40.0	5	50.0	10	0
United States and Puerto Rico.	51	29.5	83	48.0	39	22.5	173	0
Southern Canada........	9	50.0	6	33.3	3	16.7	18	0
Conterminous United States and southern Canada.	59	32.6	85	47.0	37	20.4	181	0
All sites..................	60	31.4	89	46.6	42	22.0	191	0

[Comparison of total monthly means with total monthly medians and last month's total monthly means]

Total of July means (All sites)..	1,803,950	CFS
Total of July medians (All sites)..	1,892,080	CFS
Total of last month's means (All sites)..	2,083,780	CFS
Total of July means compared to total of medians..	−4.7	Percent
Total of July means compared to total of last month's means...............................	−13.6	Percent

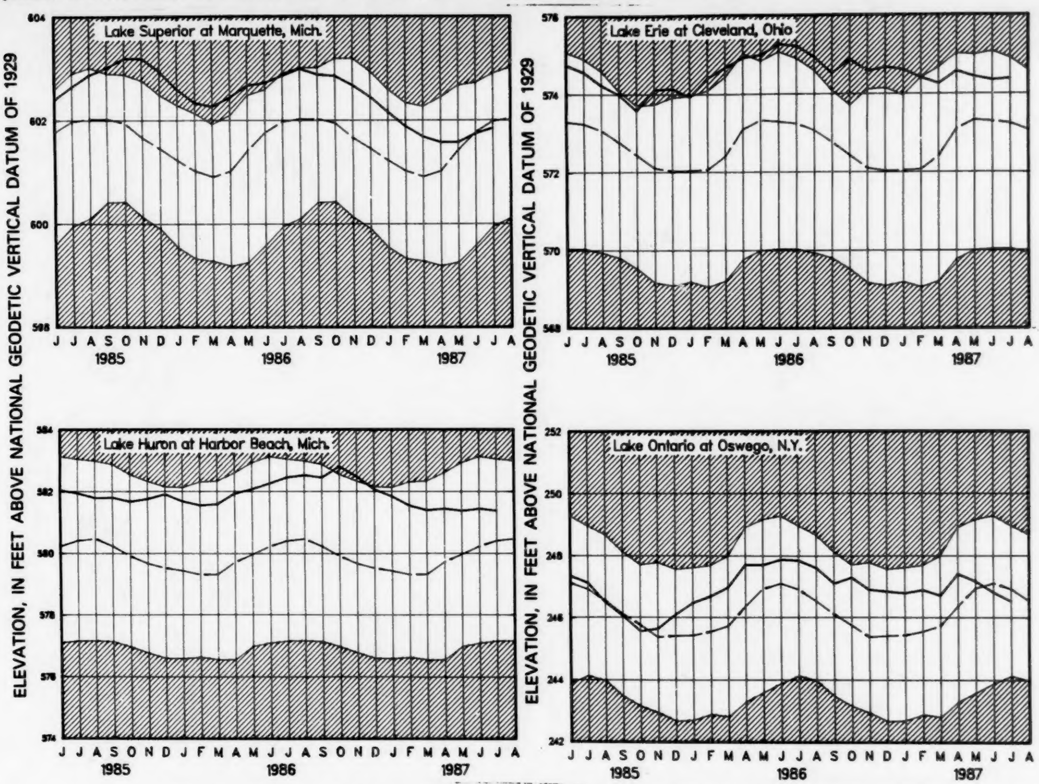
MONTHLY MEAN DISCHARGE OF SELECTED STREAMS

Unshaded area indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951–80. Heavy line indicates mean for current period.

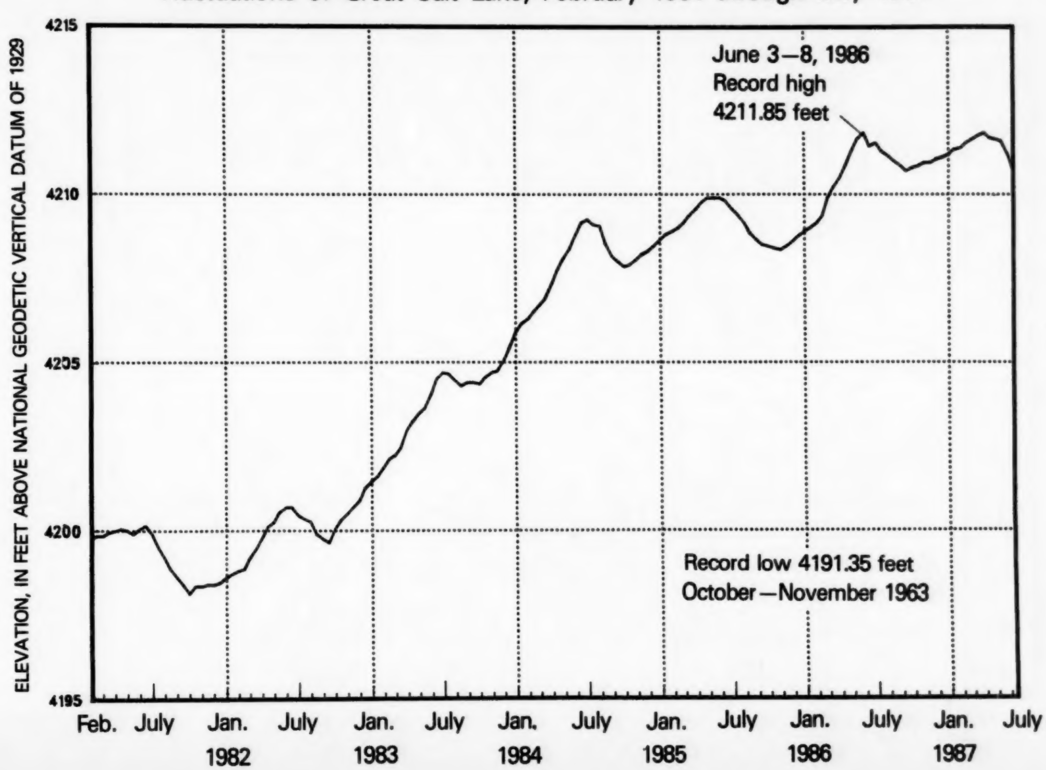


GREAT LAKES ELEVATIONS

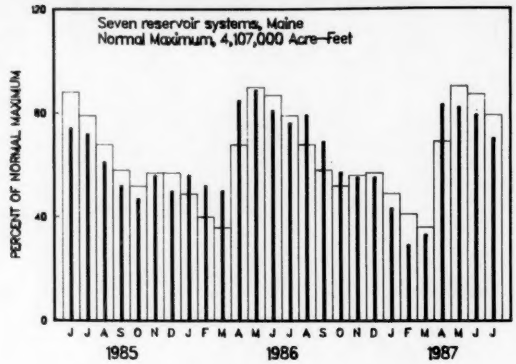
Unshaded area indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period. Data from National Ocean Service.

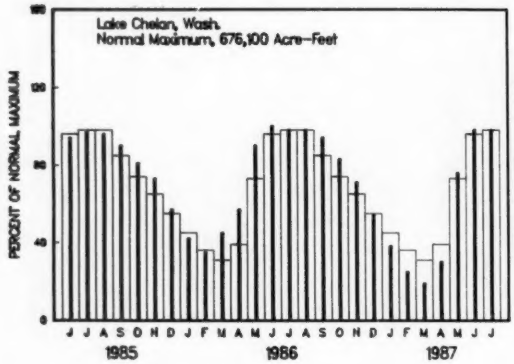


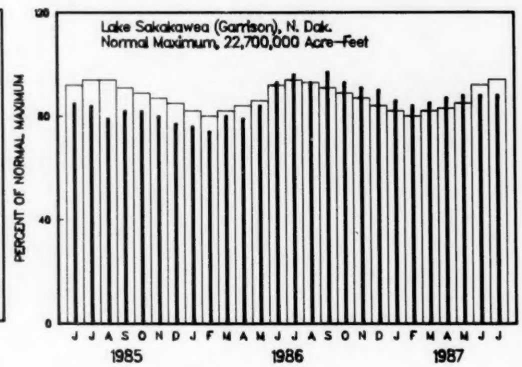
Fluctuations of Great Salt Lake, February 1981 through July 1987

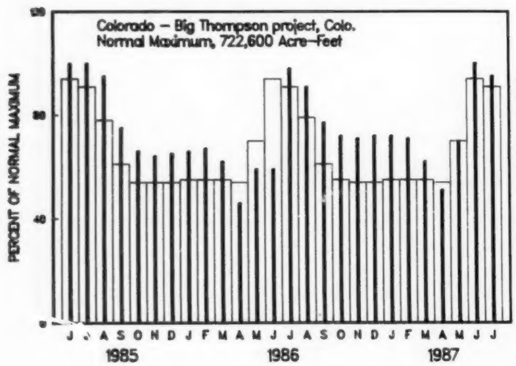


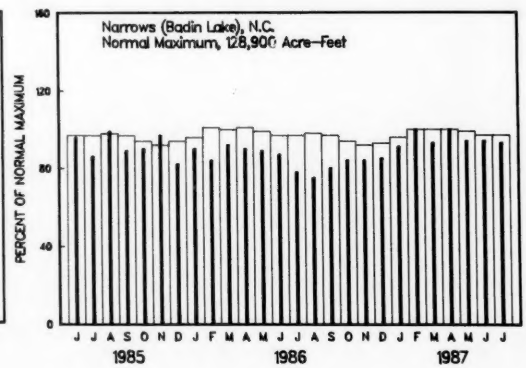
USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS

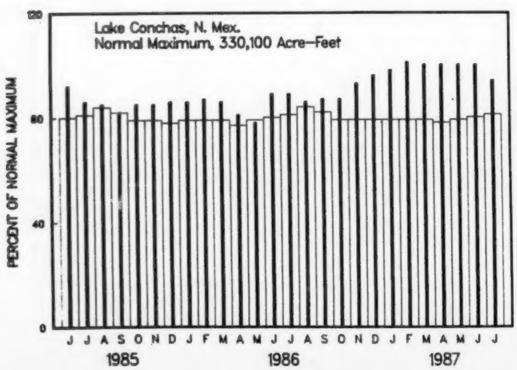


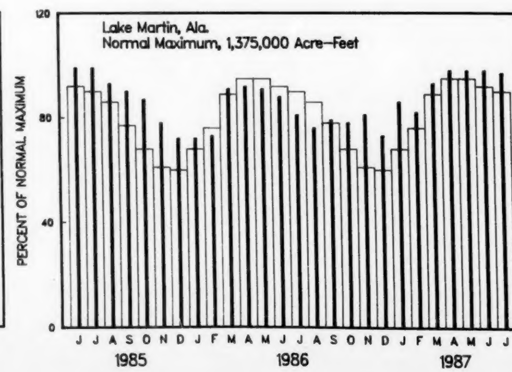












USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF JULY 1987

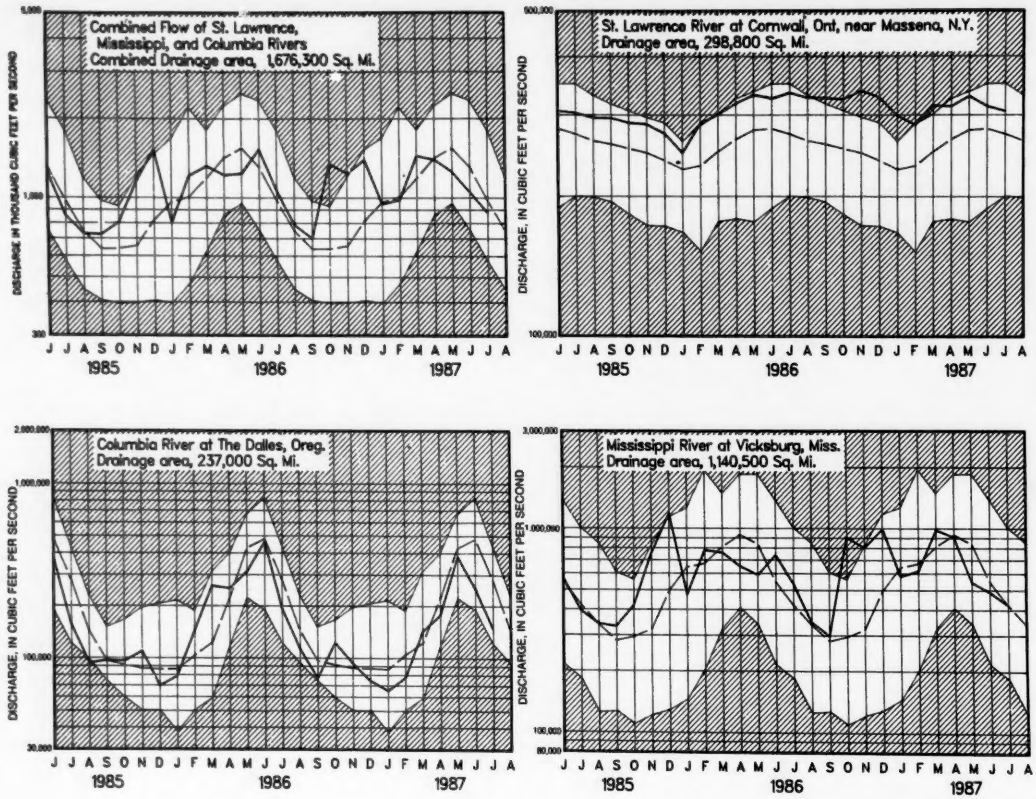
[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F-Flood control I-Irrigation M-Municipal P-Power R-Recreation W-Industrial	Percent of normal maximum				Normal maximum[a] (acre-feet)
	End of July 1987	End of July 1986	Average for end of July	End of June 1987	
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs(P)	41	41	60	45	[b]226,300
QUEBEC					
Allard (P)	87	77	76	88	280,600
Gouin (P)	66	97	69	65	6,954,000
MAINE					
Seven reservoir systems (MP)	70	76	79	79	4,107,000
NEW HAMPSHIRE					
First Connecticut Lake (P)	88	86	88	93	76,450
Lake Francis (FPR)	87	75	86	87	99,310
Lake Winnipesaukee (PR)	90	103	88	103	165,700
VERMONT					
Harriman (P)	84	89	78	92	116,200
Somerset (P)	81	90	82	90	57,390
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	84	83	83	90	77,920
NEW YORK					
Great Sacandaga Lake (FPR)	88	98	83	90	786,700
Indian Lake (FMP)	92	99	90	99	103,300
New York City reservoir system (MW)	82	89	90	88	1,680,000
NEW JERSEY					
Wanaque (M)	73	80	82	83	85,100
PENNSYLVANIA					
Allegheny (FPR)	49	52	45	49	1,180,000
Pymatuning (FMR)	100	97	93	98	188,000
Raystown Lake (FR)	68	67	63	68	761,900
Lake Wallenpaupack (PR)	73	79	74	79	157,800
MARYLAND					
Baltimore municipal system (M)	88	68	91	89	261,900
NORTH CAROLINA					
Bridgewater (Lake James) (P)	95	86	90	97	288,800
Narrows (Badin Lake) (P)	93	78	97	94	128,900
High Rock Lake (P)	82	50	77	95	234,800
SOUTH CAROLINA					
Lake Murray (P)	88	86	78	93	1,614,000
Lakes Marion and Moultrie (P)	83	84	72	88	1,862,000
SOUTH CAROLINA—GEORGIA					
Clark Hill (FP)	81	47	69	80	1,730,000
GEORGIA					
Burton (PR)	96	96	90	96	104,000
Sinclair (MPR)	89	91	90	88	214,000
Lake Sidney Lanier (FMPR)	62	38	61	66	1,686,000
ALABAMA					
Lake Martin (P)	97	81	90	98	1,375,000
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	57	44	56	66	2,293,000
Douglas Lake (FPR)	67	94	61	80	1,394,000
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	77	43	76	83	1,012,000
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	68	20	62	78	2,880,000
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	74	49	76	82	1,478,000
WISCONSIN					
Chippewa and Flambeau (PR)	77	93	83	79	365,000
Wisconsin River (21 reservoirs) (PR)	59	86	75	55	399,000
MINNESOTA					
Mississippi River headwater system (FMR)	42	47	38	38	1,640,000
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	88	96	94	88	22,700,000
SOUTH DAKOTA					
Angostura (I)	81	89	86	93	127,600
Belle Fourche (I)	66	62	55	86	185,200
Lake Francis Case (FIP)	81	77	81	76	4,834,000
Lake Oahe (FIP)	90	96	...	93	22,530,000
Lake Sharpe (FIP)	97	99	100	100	1,725,000
Lewis and Clark Lake (FIP)	86	89	93	81	432,000
NEBRASKA					
Lake McConaughy (IP)	79	91	75	85	1,948,000
OKLAHOMA					
Eufaula (FRP)	99	97	89	105	2,378,000
Keystone (FPR)	91	97	95	104	661,000
Tenkiller Ferry (FPR)	102	104	97	104	628,200
Lake Altus (FIMR)	101	41	64	100	133,000
Lake O'The Cherokees (FPR)	91	95	91	92	1,492,000
OKLAHOMA—TEXAS					
Lake Texoma (FMPRW)	98	93	100	123	2,722,000
TEXAS					
Bridgeport (IMW)	99	96	52	100	386,400
Canyon (FMR)	140	100	78	181	385,600
International Amistad (FIMPW)	98	51	73	98	3,497,000
International Falcon (FIMPW)	91	39	65	88	2,668,000
Livingston (IMW)	99	100	89	101	1,788,000
Possum Kingdom (IMPRW)	67	94	98	67	570,200
Red Bluff (PI)	75	61	24	81	307,000
Toledo Bend (P)	85	98	90	89	4,472,000
Twin Buttes (FIM)	79	23	26	79	177,800
Lake Kemp (IMW)	101	104	89	109	268,000
Lake Meredith (FWM)	38	26	38	38	796,900
Lake Travis (FIMPRW)	101	92	78	108	1,144,000
MONTANA					
Canyon Ferry (FIMPR)	80	91	92	80	2,043,000
Fort Peck (FPR)	85	82	90	85	18,910,000
Hungry Horse (FIPR)	99	100	97	99	3,451,000
WASHINGTON					
Ross (PR)	99	100	96	95	1,052,000
Franklin D. Roosevelt Lake (IP)	98	96	100	83	5,022,000
Lake Chelan (PR)	98	98	98	98	676,100
Lake Cushman (PR)	102	125	99	102	359,500
Lake Merwin (P)	101	103	105	101	245,600
IDAHO					
Boise River (4 reservoirs) (FIP)	48	73	77	64	1,235,000
Coeur d'Alene Lake (P)	100	21	82	98	238,500
Pend Oreille Lake (FP)	98	98	96	99	1,561,000
IDAHO—WYOMING					
Upper Snake River (8 reservoirs) (MP)	52	77	73	69	4,401,000
WYOMING					
Boysen (FIP)	95	95	89	93	802,000
Buffalo Bill (IP)	78	91	101	89	421,300
Keyhole (F)	43	35	49	47	193,800
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	67	82	61	79	3,056,000
COLORADO					
John Martin (FIR)	88	57	21	100	364,400
Taylor Park (IR)	95	98	91	100	106,200
Colorado-Big Thompson project (I)	80	92	73	88	730,300
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	94	98	...	96	31,620,000
UTAH—IDAHO					
Bear Lake (IPR)	76	98	69	...	1,421,000
CALIFORNIA					
Folsom (FIP)	60	80	78	71	1,000,000
Hetch Hetchy (MP)	82	100	80	87	360,400
Isabella (FIR)	36	85	46	46	568,100
Pine Flat (FI)	20	87	58	58	1,001,000
Clair Engle Lake (Lewiston) (P)	87	92	86	95	2,438,000
Lake Almanor (P)	96	97	64	95	1,036,000
Lake Berryessa (FIMW)	77	92	83	80	1,600,000
Millerton Lake (FI)	42	87	66	59	503,200
Shasta Lake (FIPR)	61	81	79	74	4,377,000
CALIFORNIA—NEVADA					
Lake Tahoe (IPR)	59	96	71	68	744,600
NEVADA					
Rye Patch (I)	56	95	75	65	194,300
ARIZONA—NEVADA					
Lake Mead and Lake Mohave (FIMP)	91	91	82	91	27,970,000
ARIZONA					
San Carlos (IP)	63	74	89	73	935,100
Salt and Verde River system (IMPR)	85	85	93	92	2,019,100
NEW MEXICO					
Conchas (FIR)	94	89	81	100	330,100
Elephant Butte and Caballo (FIPR)	94	94	33	94	2,442,000

[a]1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second day.
[b]Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

HYDROGRAPHS FOR THE "BIG THREE" RIVERS

Unshaded area indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951–80. Heavy line indicates mean for current period.



Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES, FOR JULY 1987, AT DOWNSTREAM SITES ON FIVE LARGE RIVERS

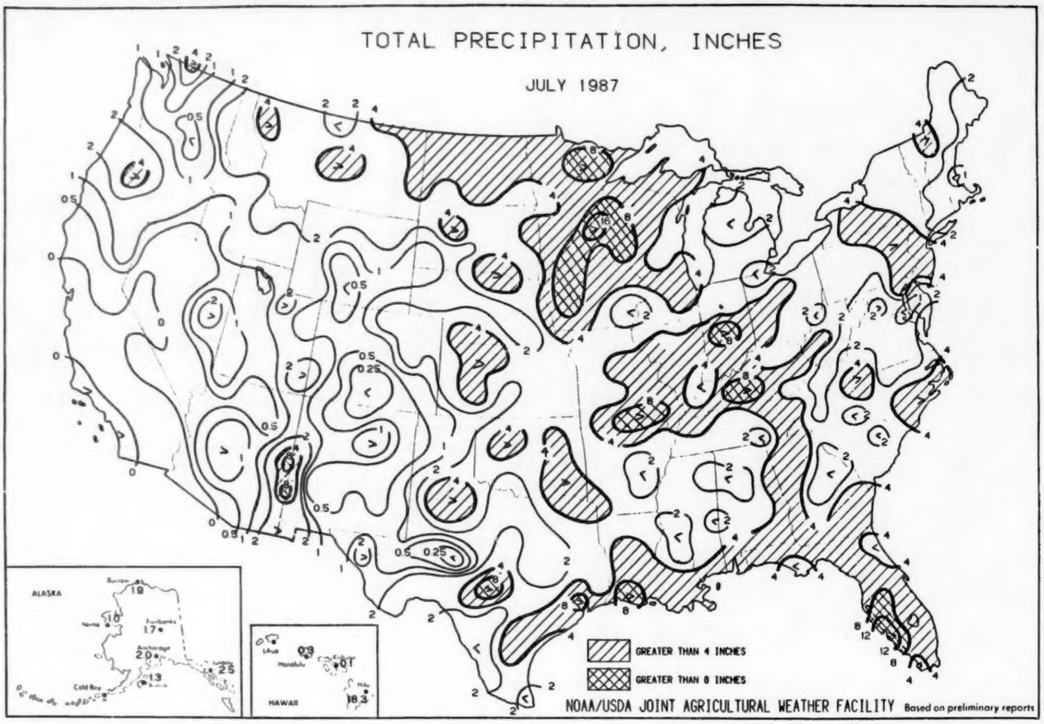
Station number	Station name	July data of following calendar years	Stream discharge during month	Dissolved-solids concentration[a]		Dissolved-solids discharge[a]			Water temperature[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean (tons per day)	Minimum (tons per day)	Maximum (tons per day)	Mean in °C	Minimum, in °C	Maximum, in °C
01463500	Delaware River at Trenton, N.J.	1987	6,855	90	121	1,962	1,254	4,201	27.0	24.0	30.0
	(Morrisville, Pa.).	1945—86	7,199	57	145	. . . .	465	16,700	. . .	18.5	33.5
		(Extreme yr)		(1947)	(1978)		(1965)	(1969)			
			[c]4,822								
07289000	Mississippi River at	1987	422,100	262	307	323,700	224,600	387,100	29.5	28.5	30.5
	Vicksburg, Miss.	1976—86	515,600	200	305	340,200	163,000	633,000	29.5	23.5	34.5
		(Extreme yr)		(1981)	(1986)		(1977)	(1980)			
			[c]421,700								
03612500	Ohio River at lock and dam 53,	1987	155,000	168	238	. . . .	35,000	177,000	. . .	27.0	27.0
	near Grand Chain, Ill. (streamflow station at Metropolis, Ill.).	1955—86	156,800	124	276	. . . .	25,000	237,000	. . .	16.5	31.0
		(Extreme yr)		(1965, 1967)	(1968)		(1966)	(1958)			
			[c]143,700								
06934500	Missouri River at Hermann,	1987	99,400	276	484	99,500	73,100	134,000	28.5	25.0	32.5
	Mo. (60 miles west of	1976—86	103,700	201	501	95,260	44,700	208,000	28.0	22.0	32.0
	St. Louis, Mo.).	(Extreme yr)		(1981)	(1985)		(1977)	(1984)			
			[c]75,690								
14128910	Columbia River at Warrendale,	1987	109,000	81	84	24,400	18,500	29,000	20.0	18.5	21.0
	Oreg. (streamflow station at	1976—86	184,600	60	93	37,300	12,500	65,100	18.5	15.5	22.0
	The Dalles, Oreg.).	(Extreme yr)		(1976)	(1977)		(1977)	(1981)			
			[c]279,500								

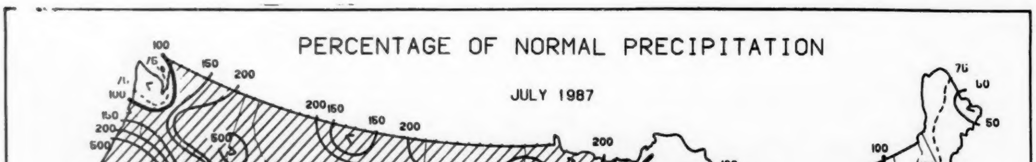
[a]Dissolved-solids concentrations, when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1951—80, for comparison with data for current month.

FLOW OF LARGE RIVERS DURING JULY 1987

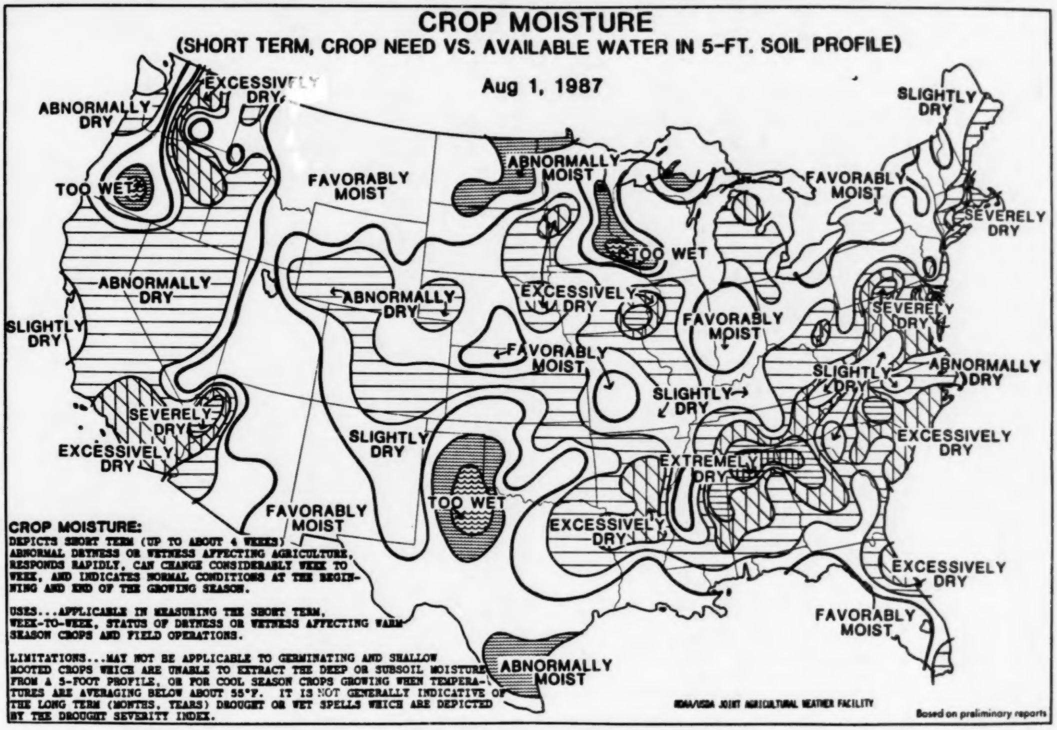
Station number	Stream and place of determination	Drainage area (square miles)	Average discharge through September 1980 (cubic feet per second)	July 1987: Monthly mean discharge (cubic feet per second)	July 1987: Percent of median monthly discharge, 1951—80	July 1987: Change in discharge from previous month (percent)	Discharge near end of month: Cubic feet per second	Discharge near end of month: Million gallons per day	Discharge near end of month: Date
01014000	St. John River below Fish River at Fort Kent, Maine	5,690	9,647	5,789	125	−9	3,150	2,035	31
01318500	Hudson River at Hadley, N.Y.	1,664	2,909	1,960	189	−24	1,210	782	31
01357500	Mohawk River at Cohoes, N.Y.	3,456	5,734	2,060	110	+4	750	484	31
01463500	Delaware River at Trenton, N.J.	6,780	11,750	6,855	142	+43	4,400	2,840	31
01570500	Susquehanna River at Harrisburg, Pa.	24,100	34,530	17,250	146	+26	7,440	4,808	29
01646500	Potomac River near Washington, D.C.	11,560	[1]11,490	[1]5,290	132	−14	...	...	..
02105500	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	5,005	1,160	59	−17	...	...	..
02131000	Pee Dee River at Peedee, S.C.	8,830	9,851	7,450	131	+15	6,410	4,142	31
02226000	Altamaha River at Doctortown, Ga.	13,600	13,880	6,970	105	+23	3,150	2,035	27
02320500	Suwannee River at Branford, Fl.	7,880	6,987	5,550	108	−4	4,580	2,960	31
02358000	Apalachicola River at Chattahoochee, Fl.	17,200	22,570	19,300	143	+29	12,200	7,890	30
02467000	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	23,300	6,524	104	−27	3,450	2,229	31
02489500	Pearl River near Bogalusa, La.	6,630	9,768	3,574	110	−32	2,650	1,712	31
03049500	Allegheny River at Natrona, Pa.	11,410	[1]19,480	[1]20,820	347	+83	5,240	3,386	27
03085000	Monongahela River at Braddock, Pa.	7,337	[1]12,510	[1]4,820	119	−42	3,050	1,971	22
03193000	Kanawha River at Kanawha Falls, W.Va.	8,367	12,590	4,655	91	−29	2,730	1,764	30
03234500	Scioto River at Higby, Ohio	5,131	4,547	7,293	433	+58	830	536	31
03294500	Ohio River at Louisville, Ky.[2]	91,170	11,600	107,100	218	+48	78,330	50,625	28
03377500	Wabash River at Mount Carmel, Ill.	28,635	27,220	21,570	139	+46	8,810	5,694	31
03469000	French Broad River below Douglas Dam, Tenn.	4,543	6,798	3,505	85	−27	...	...	..
04084500	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[2]	6,150	4,163	1,796	75	−32	1,741	1,125	31
04264331	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y.[3]	298,800	242,700	305,600	112	−2	293,000	189,400	31
02NG001	St. Maurice River at Grand Mere, Quebec	16,300	25,150	16,600	84	0	17,200	11,120	31
05082500	Red River of the North at Grand Forks, N.Dak.	30,100	2,551	3,617	136	+42	10,400	6,720	27
05133500	Rainy River at Manitou Rapids, Minn.	19,400	11,830	4,700	29	−12	9,660	6,243	28
05330000	Minnesota River near Jordan, Minn.	16,200	3,402	2,590	62	−20	2,140	1,383	31
05331000	Mississippi River at St. Paul, Minn.	36,800	[1]10,610	7,179	55	−35	10,500	6,790	31
05365500	Chippewa River at Chippewa Falls, Wis.	5,600	5,100	2,357	74	+8	5,300	3,430	31
05407000	Wisconsin River at Muscoda, Wis.	10,300	8,617	4,806	85	−5	6,228	4,025	31
05446500	Rock River near Joslin, Ill.	9,551	5,873	2,990	86	−41	3,000	1,900	31
05474500	Mississippi River at Keokuk, Iowa	119,000	62,620	38,874	62	−20	59,700	38,580	31
06214500	Yellowstone River at Billings, Mont.	11,796	7,038	6,120	41	−41	5,120	3,309	31
06934500	Missouri River at Hermann, Mo.	524,200	79,490	99,380	131	−6	68,100	44,010	31
07289000	Mississippi River at Vicksburg, Miss.[4]	1,140,500	576,600	422,600	100	−14	410,000	265,000	27
07331000	Washita River near Dickson, Okla.	7,202	1,368	3,510	844	−69	1,000	600	31
08276500	Rio Grande below Taos Junction Bridge, near Taos, N.Mex.	9,730	725	793	243	−79	331	213	29
09315000	Green River at Green River, Utah	44,850	6,298	3,037	53	−49	2,660	1,720	27
11425500	Sacramento River at Verona, Calif.	21,257	18,820	14,040	144	+47	14,800	9,570	29
13269000	Snake River at Weiser, Idaho	69,200	18,050	8,390	76	−6	8,403	5,431	31
13317000	Salmon River at White Bird, Idaho	13,550	11,250	4,830	33	−49	3,656	2,362	31
13342500	Clearwater River at Spalding, Idaho	9,570	15,480	4,728	43	−45	2,099	1,357	31
14105700	Columbia River at The Dalles, Oreg.[5]	237,000	[1]193,100	[1]147,700	53	−41	112,800	72,900	29
14191000	Willamette River at Salem, Oreg.	7,280	[1]23,510	[1]5,080	92	−12	6,090	3,936	29
15515500	Tanana River at Nenana, Alaska	25,600	23,460	61,090	105	+65	64,000	41,400	31
08MF005	Fraser River at Hope, British Columbia.	83,800	96,290	145,100	76	−30	122,500	79,190	31

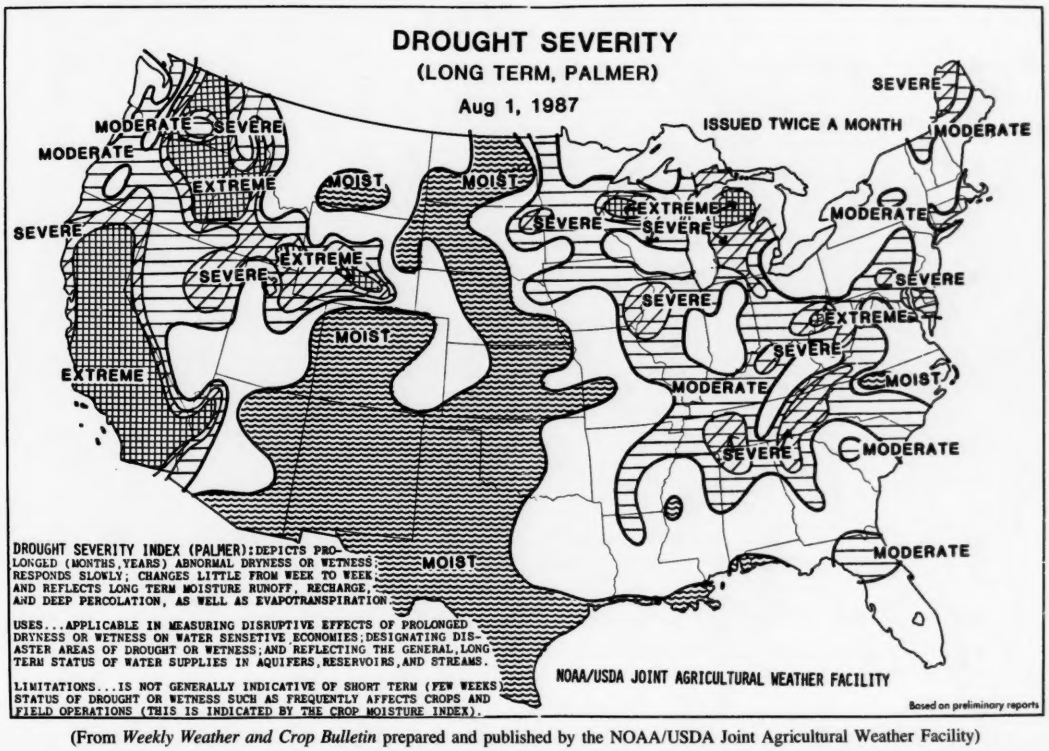
[1]Adjusted.
[2]Records furnished by Corps of Engineers.
[3]Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.





(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)





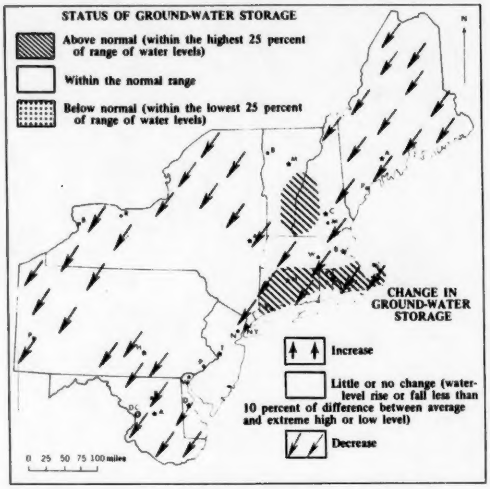
(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)

GROUND-WATER CONDITIONS DURING JULY 1987

Ground-water levels continued to decline seasonally in most of the Northeast, including New England (except parts of New Hampshire and Vermont), northern and western New York State, western and south-central Pennsylvania, and in Maryland and Delaware. (See map). Elsewhere in the region, there were mixed changes in water levels. Levels near the end of July remained above average in southeastern Massachusetts and in much of Connecticut and Rhode Island. Levels were also above average in parts of New Hampshire and Vermont. Elsewhere in the Northeast, levels were generally above or below average for this time of year.

In the Southeastern States, water-level changes were mixed in West Virginia and Kentucky, and declined in Virginia, North Carolina, Arkansas, Louisiana, Mississippi, and Florida, and declined in all but one observation well in Georgia. Ground-water level in the single active observation well in Alabama, at Montgomery, rose but was below the long-term average. Water levels were above long-term averages in Kentucky, below average in Arkansas and Louisiana, and mixed with respect to average in West Virginia, Virginia, and North Carolina. A new low ground-water level for July was reached in the key well at Memphis in western Tennessee.

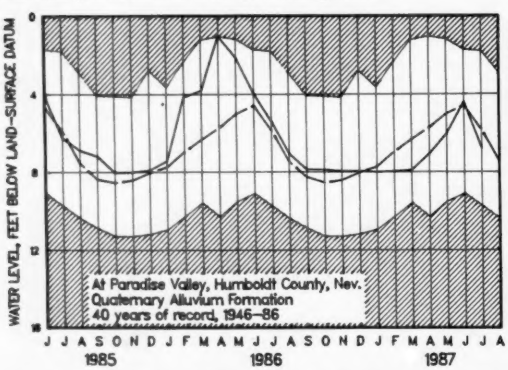
In the central and western Great Lakes States, ground-water levels declined in Minnesota, Wisconsin, and Michigan. Water-level changes were mixed in Iowa. Levels were about average in Wisconsin and Indiana, and below average in Minnesota and Michigan. Levels were mixed with respect to average in Iowa.

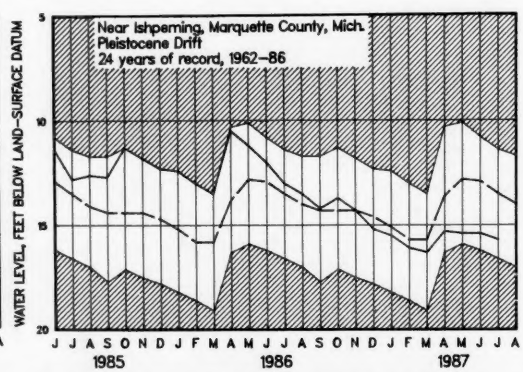


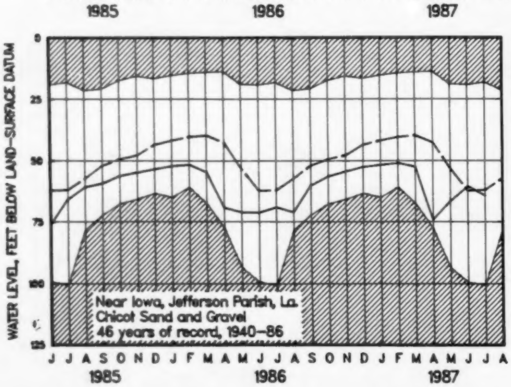
Map showing ground-water storage near end of July and change in ground-water storage from end of June to end of July.

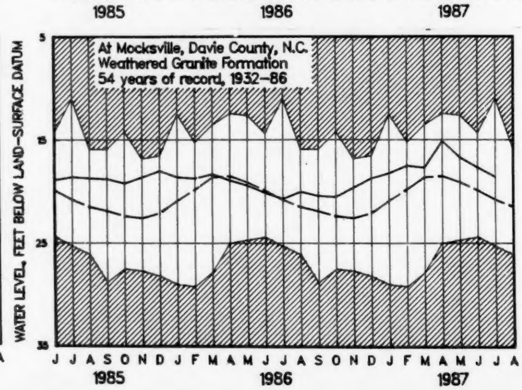
MONTH-END GROUND-WATER LEVELS IN KEY WELLS

Unshaded area indicates range between highest and lowest record for the month. Dashed line indicates average of monthly levels in previous years. Heavy line indicates level for current period.









In the Western States, net changes in ground-water levels were mixed in Idaho, Utah, Kansas, New Mexico, and Texas. Levels declined in Washington, North Dakota, Nebraska, southern California, and Nevada. Water levels were below long-term averages in Washington and North Dakota. Levels were mixed with respect to average in Idaho, Nebraska, southern California, Nevada, Utah, Kansas, New Mexico, and Texas. New high ground-water levels for July occurred at wells in Nevada and New Mexico, and a new all-time high level (27 years of record) was reached in the observation well in the Blanding area in Utah. New July low levels occurred in New Mexico and Texas, and a new all-time low level (41 years of record) was reached in the key well in Las Vegas Valley in Nevada.

Provisional data; subject to revision

WATER LEVELS IN KEY OBSERVATION WELLS IN SOME REPRESENTATIVE AQUIFERS IN THE CONTERMINOUS UNITED STATES—JULY 1987

Aquifer and Location	Water level in feet with reference to land-surface datum	Departure from average in feet	Net change in water level in feet since:		Year records began	Remarks
			Last month	Last year		
Glacial drift at Hanska, south-central Minnesota.	−8.50	−2.27	−0.36	−3.43	1942	
Glacial drift at Roscommon in north-central part of Lower Peninsula, Michigan.	−5.72	−1.00	−0.27	−1.40	1935	Equals 1936 July low.
Glacial drift at Marion, Iowa	−5.32	−0.17	−1.15	−1.40	1941	
Glacial drift at Princeton in northwestern Illinois.	−9.60	+2.13	−0.82	−2.56	1943	
Petersburg Granite, southeastern Piedmont near Fall Zone, Colonial Heights, Virginia.	−15.70	−0.09	−0.81	+0.67	1939	
Glacial outwash sand and gravel, Louisville, Kentucky (U.S. well no. 2).	−18.48	+6.22	+0.14	−0.82	1946	
500-foot sand aquifer near Memphis, Tennessee (U.S. well no. 2).	−106.46	−16.61	−0.26	−1.66	1941	July low.
Weathered granite, Mocksville area, Davie County, western Piedmont, North Carolina.	−18.66	+1.89	−1.01	+2.36	1932	
Sparta Sand in Pine Bluff industrial area, Arkansas.	−230.50	−23.39	−1.30	−8.54	1958	
Eutaw Formation in the City of Montgomery, Alabama (U.S. well no. 4).	−23.4	−0.6	+2.8	+4.8	1952	
Limestone aquifer on Cockspur Island, Savannah area, Georgia (U.S. well no. 6).	−37.22	−9.38	−2.14	+0.38	1956	
Sand and gravel in Puget Trough, Tacoma, Washington.	−111.97	−0.94	−1.39	+0.06	1952	
Pleistocene glacial outwash gravel, North Pole, northern Idaho (U.S. well no. 3).	−464.2	−4.9	0.0	−2.5	1929	
Snake River Group: Snake River Plain Aquifer, at Eden, Idaho (U.S. well no. 4).	−118.0	−0.3	+1.4	+2.5	1957	
Alluvial valley fill in Flowell area, Millard County, Utah (U.S. well no. 9).	−20.48	+19.57	−0.29	−5.93	1929	
Alluvial sand and gravel, Platte River Valley, Ashland, Nebraska (U.S. well no. 6).	−4.82	+0.60	−1.32	+0.05	1935	
Alluvial valley fill in Steptoe Valley, Nevada	−8.13	+4.87	−0.65	+0.47	1950	July high.
Pleistocene terrace deposits in Kansas River valley, at Lawrence, northeastern Kansas.	−17.16	+3.30	−1.15	+0.47	1953	
Alluvium and Paso Robles clay, sand, and gravel, Santa Maria, California	−122.50	+18.19	−1.00	+0.02	1957	
Valley fill, Elfrida area, Douglas, Arizona (U.S. well no. 15).	−103.3	. . .	+0.1	+1.9	1951	
Hueco bolson, El Paso area, Texas	−268.38	−17.31	+0.21	−1.42	1965	July low.
Evangeline aquifer, Houston area, Texas	−308.12	− 6.70	−1.35	+3.88	1965	

ICE VOLUMES ON CASCADE VOLCANOES: MOUNT RAINIER, MOUNT HOOD, THREE SISTERS, AND MOUNT SHASTA

The abstract and illustrations below are from the report, *Ice volumes on Cascade volcanoes: Mount Rainier, Mount Hood, Three Sisters, and Mount Shasta*, by Carolyn L. Driedger and Paul M. Kennard, U.S. Geological Survey Professional Paper 1365, 28 pages, 6 plates, 1986. This report may be purchased for $10.00 from U.S. Geological Survey, Books and Open-File Reports, Box 25425, Federal Center, Denver, CO 80225 (check or money order payable to U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (payable to Superintendent of Documents).

ABSTRACT

During the eruptions of Mount St. Helens the occurrence of floods and mudflows made apparent the need for predictive water-hazard analysis of other Cascade volcanoes. A basic requirement for such analysis is information about the volumes and distributions of snow and ice on other volcanoes.

A radar unit contained in a backpack was used to make point measurements of ice thickness on major glaciers of Mount Rainier, Wash.; Mount Hood, Oreg.; the Three Sisters, Oreg.; and Mount Shasta, Calif. (see figure 1). The measurements were corrected for slope and were used to develop subglacial contour maps from which glacier volumes were measured.

These values were used to develop estimation methods for finding volumes of unmeasured glaciers. These methods require a knowledge of glacier slope, altitude, and area and require an estimation of basal shear stress, each estimate derived by using topographic maps updated by aerial photographs. The estimation methods were found to be accurate within ±20 percent on measured glaciers and to be within ±25 percent when applied to unmeasured glaciers on the Cascade volcanoes. The estimation methods may be applicable to other temperate glaciers in similar climatic settings.

Areas and volumes of snow and ice are as follows: Mount Rainier, 991 million ft^2, 156 billion ft^3; Mount Hood, 145 million ft^2, 12 billion ft^3; (see table 1); Three Sisters, 89 million ft^2, 6 billion ft^3; and Mount Shasta, 74 million ft^2, 5 billion ft^3.

The distribution of ice and firn patches within 58 glacierized basins on volcanoes is mapped and listed by altitude and by watershed to facilitate water-hazard analysis.

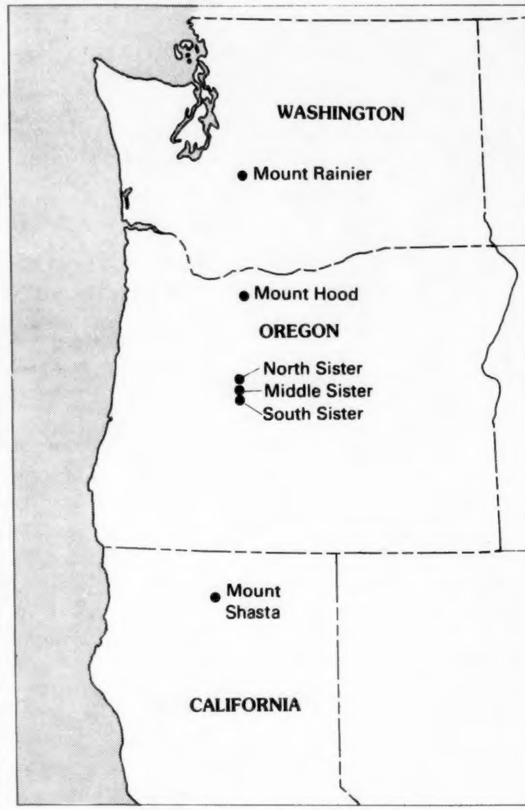


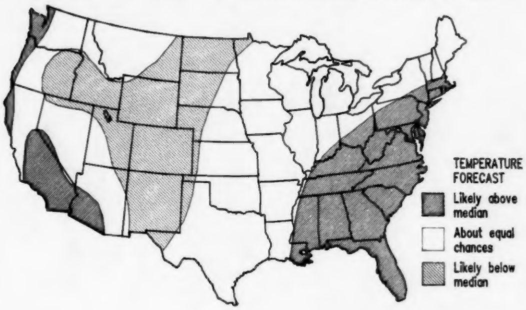
Figure 1. Location of volcanoes studied.

Table 1. *Areas and volumes of glacier ice and snow on Mount Hood*

[Methods of determination: A, volume estimated by using area correlation; M, glacier thickness measured by ice radar. Because total glacier areas are required in the application of the volume estimation method, volumes are available by total glacier. Area measured in ft^2 (× 10^6); volume measured in ft^3 (× 10^9). --in the area column means no ice or snow present for glaciers at that elevation, and in the volume column it means volume by elevation not determined for that glacier]

		Altitude Interval																
		5,000–6,000′		6,000–7,000′		7,000–8,000′		8,000–9,000′		9,000–10,000′		10,000–11,000′		11,000–11,245′				
Drainage area	Glacier or snow patch	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area total	Volume total	Method of determination
White River	Snow patches	--	--	0.5	--	1.2	--	0.8	--	0.4	--	--	--	--	--	2.9	0.2	A
	Coalman	--	--	--	--	--	--	--	--	--	--	.6	.03	--	--	.6	.03	M
	White River	--	--	.01	.0008	3.2	.2	2.3	.19	.3	.008	--	--	--	--	5.8	.3	M
Subtotal		--	--	.5	--	4.4	--	3.1	--	.7	--	.6	--	--	--	9.3	.5	
Hood River	Snow patches	.5	--	8.3	--	9.9	--	.6	--	--	--	--	--	.1	--	19.4	1.0	A
	Newton-Clark	--	--	--	--	2.1	.05	12.3	.9	5.7	.4	1.3	.03	--	--	21.4	1.4	M
	Coe	.3	.09	3.7	.5	5.0	.8	2.0	.2	1.7	.2	.7	.04	--	--	13.4	1.9	M
	Ladd	--	--	1.0	.04	5.9	.5	2.5	.3	.3	.01	--	--	--	--	9.7	.9	M
	Eliot	--	--	4.6	.9	7.2	1.4	4.1	.7	1.3	.1	.9	.1	--	--	18.1	3.2	M
	Langille	--	--	--	--	.4	.02	2.9	.2	1.0	.06	--	--	--	--	4.3	.3	M
Subtotal		.8	--	17.6	--	30.5	--	24.4	--	10.0	--	2.9	--	.1	--	86.3	8.7	
Zigzag River	Snow patches	--	--	3.9	--	7.8	--	1.5	--	.5	--	--	--	.2	--	13.9	.7	A
	Zigzag	--	--	--	--	1.3	.04	4.5	.3	2.4	.2	.1	.005	--	--	8.3	.6	M
	Palmer	--	--	--	--	.6	.04	.8	.03	--	--	--	--	--	--	1.4	.07	M
	Coalman	--	--	--	--	--	--	--	--	--	--	.3	.01	--	--	.3	.01	M
Subtotal		--	--	3.9	--	9.7	--	6.8	--	2.9	--	.4	--	.2	--	23.9	1.4	
Sandy River	Snow patches	.2	--	2.3	--	.8	--	.4	--	.3	--	.6	--	.1	--	4.7	.2	A
	Sandy	--	--	3.1	.1	8.0	.6	1.7	.1	--	--	--	--	--	--	12.8	.8	M
	Reid	--	--	.9	.03	2.2	.1	4.0	.4	1.0	.06	--	--	--	--	8.1	.6	M
Subtotal		.2	--	6.3	--	11.0	--	6.1	--	1.3	--	.6	--	.1	--	25.6	1.7	
Total		1.0		28.3		55.6		40.4		14.9		4.5		.4		145.1	12.3	

TEMPRATURE OUTLOOK FOR AUGUST THROUGH OCTOBER 1987



PRECIPITATION OUTLOOK FOR AUGUST THROUGH OCTOBER 1987

NATIONAL WATER CONDITIONS

JULY 1987

Based on reports from the Canadian and U.S. Field offices; completed August 20, 2087

TECHNICAL STAFF	Thomas G. Ross, Editor Carroll W. Saboe, Asst. Editor John C. Kammerer Allen Sinnott Krishnaveni V. Sarma Sharon A. Edmonds Carole J. Marlow
COPY PREPARATION	Lois C. Fleshmon Sharon L. Peterson Aisha P.R. Law
GRAPHICS	Frances L. Buchanan Carolyn L. Moss

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EXPLANATION OF DATA (Revised April 1987)

Cover map shows generalized pattern of streamflow for the month based on provisional data from 183 index gaging stations—18 in Canada, 163 in the United States, and 2 in the Commonwealth of Puerto Rico. Alaska, Hawaii, and Puerto Rico inset maps show streamflow only at the index gaging stations that are located near the point shown by the arrows. Classifications on map are based on comparison of streamflow for the current month at each index station with the flow for the same month in the 30-year reference period, 1951-80. Shorter reference periods are used for one Canadian index station, two Kansas index stations, one New York index station, and the Puerto Rico index stations because of the limited records available.

The *persistence/change* map shows where streamflow has persisted in the above- or below-normal range from last month to this month and also where streamflow is in the above- or below-normal range this month after being in a different range last month. The table below the map shows areal streamflow range conditions for all index stations reporting data for this month and compares total flow of the stations reporting data for both last month and this month.

The comparative data are obtained by ranking the 30 flows for each month of the reference period in order of decreasing magnitude—the highest flow is given a ranking of 1 and the lowest flow is given a ranking of 30. Quartiles (25-percent points) are computed by averaging the 7th and 8th highest flows (upper quartile), 15th and 16th highest flows (middle quartile and median), and the 23rd and 24th highest flows (lower quartile). The upper and lower quartiles set off the highest 25 percent of flows and lowest 25 percent of flows, respectively, for the reference period. The median (middle quartile) is the middle value by definition. For the reference period, 50 percent of the flows are greater than the median, 50 percent are less than the median, 50 percent are between the upper and lower quartiles (in the normal range) 25 percent are greater than the upper quartile (above normal), and 25 percent are less than the lower quartile (below normal). Flow for the current month is then classified as; *above normal* if it is greater than the upper quartile, *in the normal range* if it is between the upper and lower quartiles, and *below normal* if it is less than the lower quartile. Change in flow from the previous month to the current month is classified as *seasonal* if the change is in the same direction as the change in the median. If the change is in the opposite direction of the change in the median, the change is classified as *contraseasonal* (opposite to the seasonal change). For example: at a particular index station, the January median is greater than the December median; if flow for the current January increased from December (the previous month), the increase is seasonal; if flow for the current January decreased from December, the decrease is contraseasonal.

Flood-frequency analyses define the relation of flood peak magnitude to probability of occurrence or recurrence interval. *Probability of occurrence* is the chance that a given flood magnitude will be exceeded in any one year. *Recurrence interval* is the reciprocal of probability of occurrence and is the *average* number of years between occurrences. For example, a flood having a probability of occurrence of 0.01 (1 percent) has a recurrence interval of 100 years. *Recurrence intervals imply no regularity of occurrence;* a 100-year flood might be exceeded in consecutive years or it might not be exceeded in a 100-year period.

Statements about *ground-water levels* refer to conditions near the end of the month. The water level in each key observation well is compared with average level for the end of the month determined from the 30-year reference period, 1951-80, or from the entire past record for that well when only limited records are available. Comparative data for ground-water levels are obtained in the same manner as comparative data for streamflow. *Changes in ground-water levels,* unless described otherwise, are from the end of the previous month to the end of the current month.

Dissolved solids and temperature data for July are given for five stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). *Dissolved solids* are minerals dissolved in water and usually consist predominately of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. *Dissloved-solids discharge* represents the total daily amount of dissolved minerals carried by the stream. *Dissolved-solids concentrations* are generally higher during periods of low streamflow, but the highest dissolved-solids *discharges* occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

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